

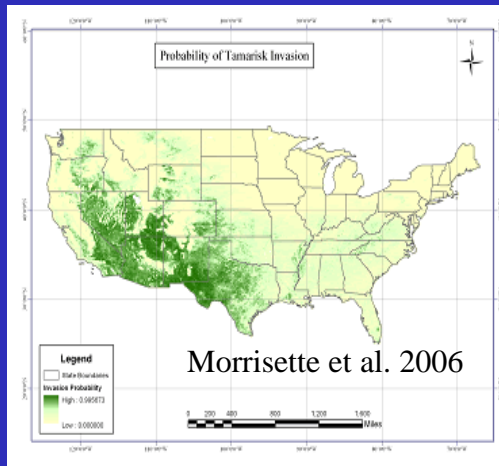
How Will Tamarisk Biocontrol Affect Wildlife?



T. Dudley, Mike Kuehn & Iwona Kuszinska (UCSB),
Matt Brooks & Steve Ostoja (USGS), Heather Bateman
(Arizona St. U), Dan Bean (Colo Dept of Ag), et al.
and a **Cast of Millions...of beetles**



- *Tamarix* spp. occupy >1 million acres in No. America
- *Tamarix* is the 3rd most common woody plant in Western riparian areas (Friedman et al. 2005)



Ecosystem Impacts of Tamarix



Displaces native riparian plants



High water transpiration

Desiccates & Salinates soils

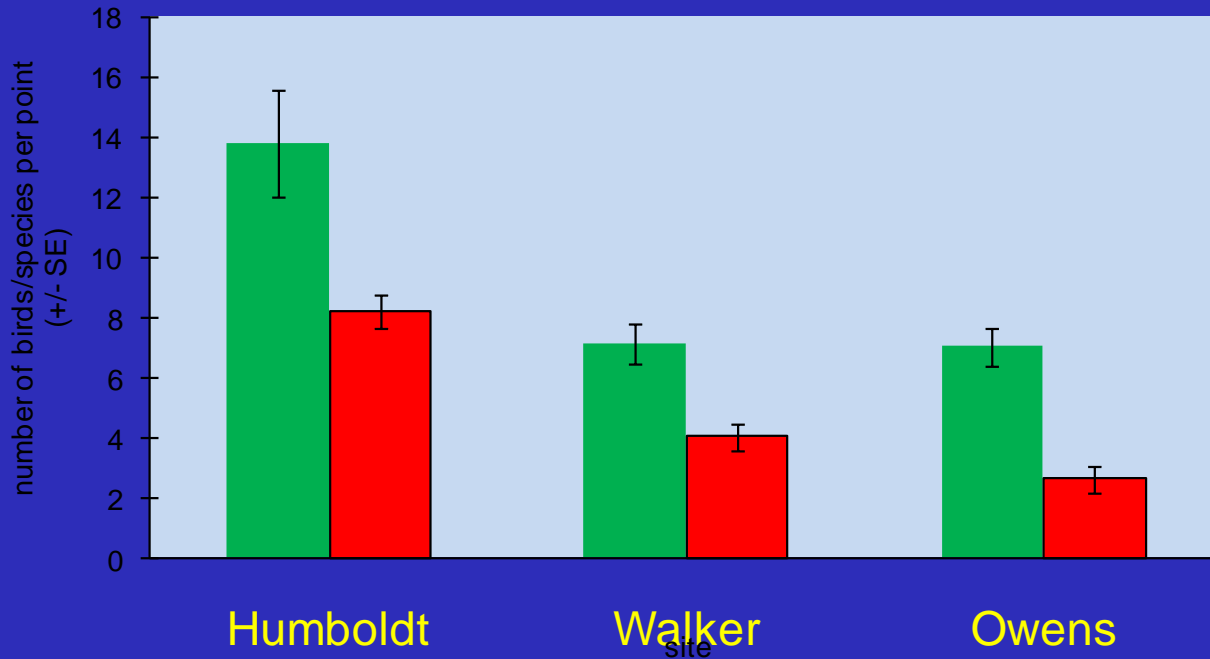


Erosion & Sedimentation



Wildfire hazard

Biodiversity Impacts of *Tamarix*



■ # birds native
■ # birds tamarisk

Insectivorous songbirds reduced,
Specialists (e.g. cavity nesters, frugivores) mostly absent
(Anderson & Ohmart 1984, Yong & Finch 1997, Ellis 1995, Shafroth et al. 2005)

Herpetofauna lower in saltcedar-dominated communities
(Jakle & Gatz 1985, Konkle 1996, Szaro & Belfit 1986)



Conventional control – Expensive/Unsustainable



Collateral damage to natural resources

Disturbance promotes other 2° weeds



Salsola spp.
(Russian thistle)



Biocontrol as Cost-Effective, 'Safe' Alternative

Initiated in 1970's - 3 candidates approved in 1996



Diorhabda 'elongata'
(saltcedar leaf beetle)
from central Asia
(now *D. carinulata*)



J. DeLoach in
Kazakhstan



Coniatus tamarisci
(weevil)



Trabutina mannipara
(mealy bug)

Southwestern Willow Flycatcher (SWFL) (*Empidonax traillii extimus*) listed as

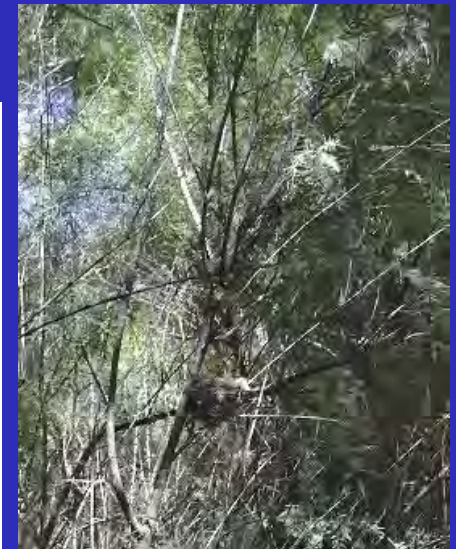
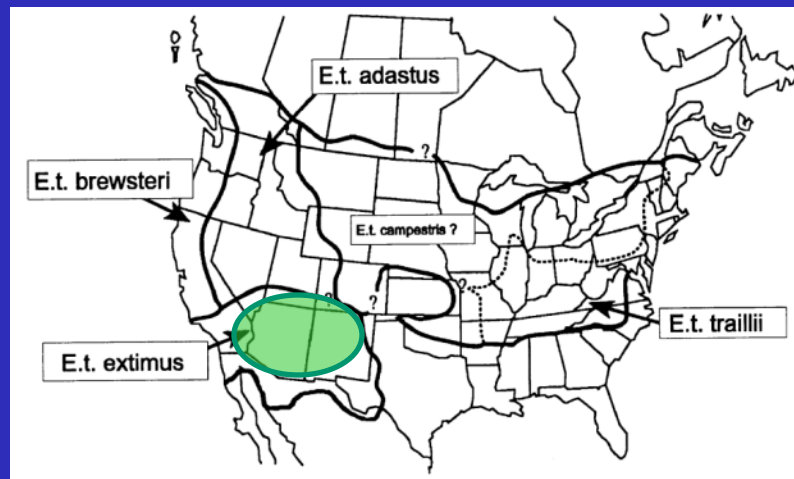
Endangered Species in 1995

Cause for listing: Loss of Cottonwood/Willow
vegetation across Southwest

Tamarix Invasion listed as major factor in decline

Can nest in *Tamarix* – Approx 1% occupied

(parts of Arizona, New Mexico, Nevada, Utah)



Biocontrol Program halted by US-FWS for ESA Section 7 Consultation

- Defoliation could expose nest to excessive heat
- Biocontrol may eradicate target too fast for native regeneration
- Habitat too degraded for natives
- Beetles may be toxic



Cage tests
in 1999



Open release 2001:
D. carinulata from
China (12 sites)



Humboldt River (NV) in 2002



Defoliation rapid -
'scraping' tissue
causes desiccation



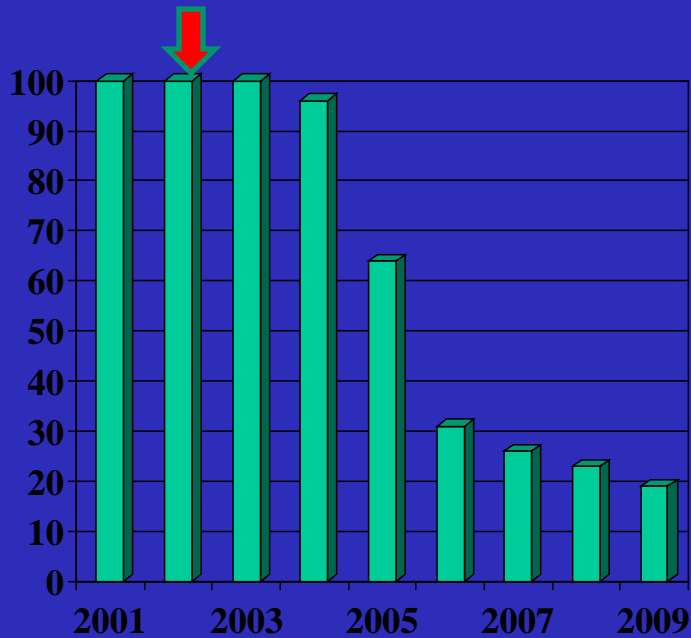
Population Expansion

2003: 2 ha. \uparrow to 200 ha.

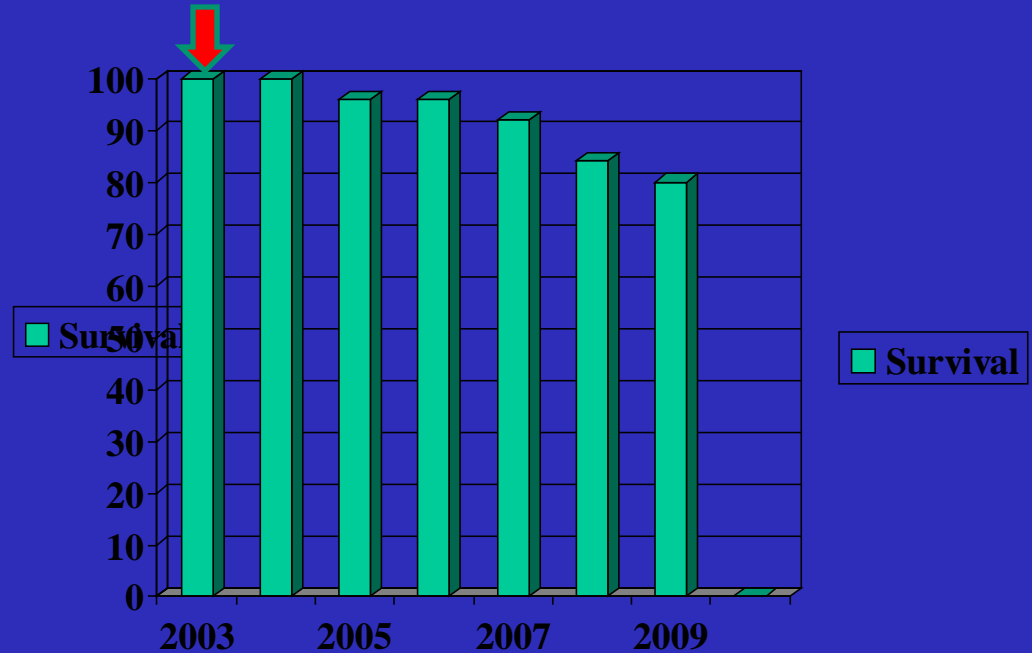
2004: >10,000 ha. colonized



But, Re-growth is Rapid
Dieback gradual &
Mortality low

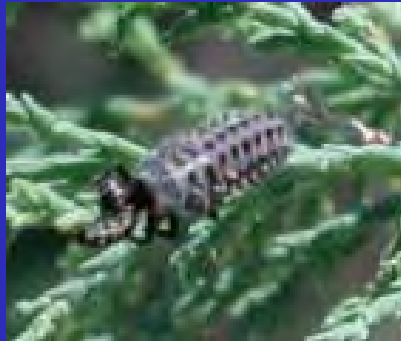
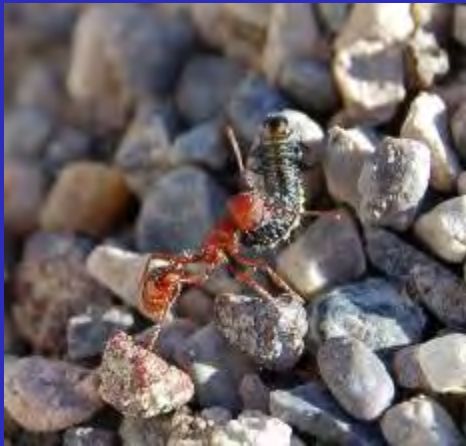


Survival at Release Site

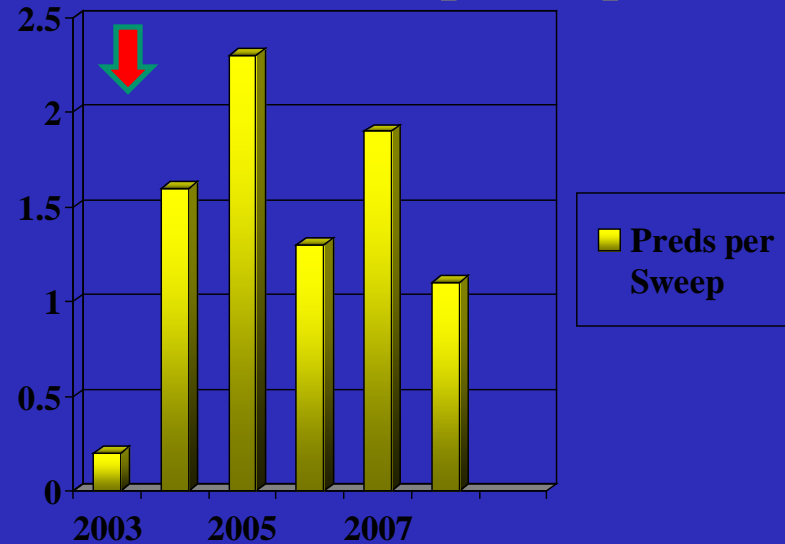


Survival 4 km from Release Site

Higher Trophic Level Response



Standard Sweep Samples



Introducing a new trophic level (Primary Consumer) promotes higher trophic levels (Predators)

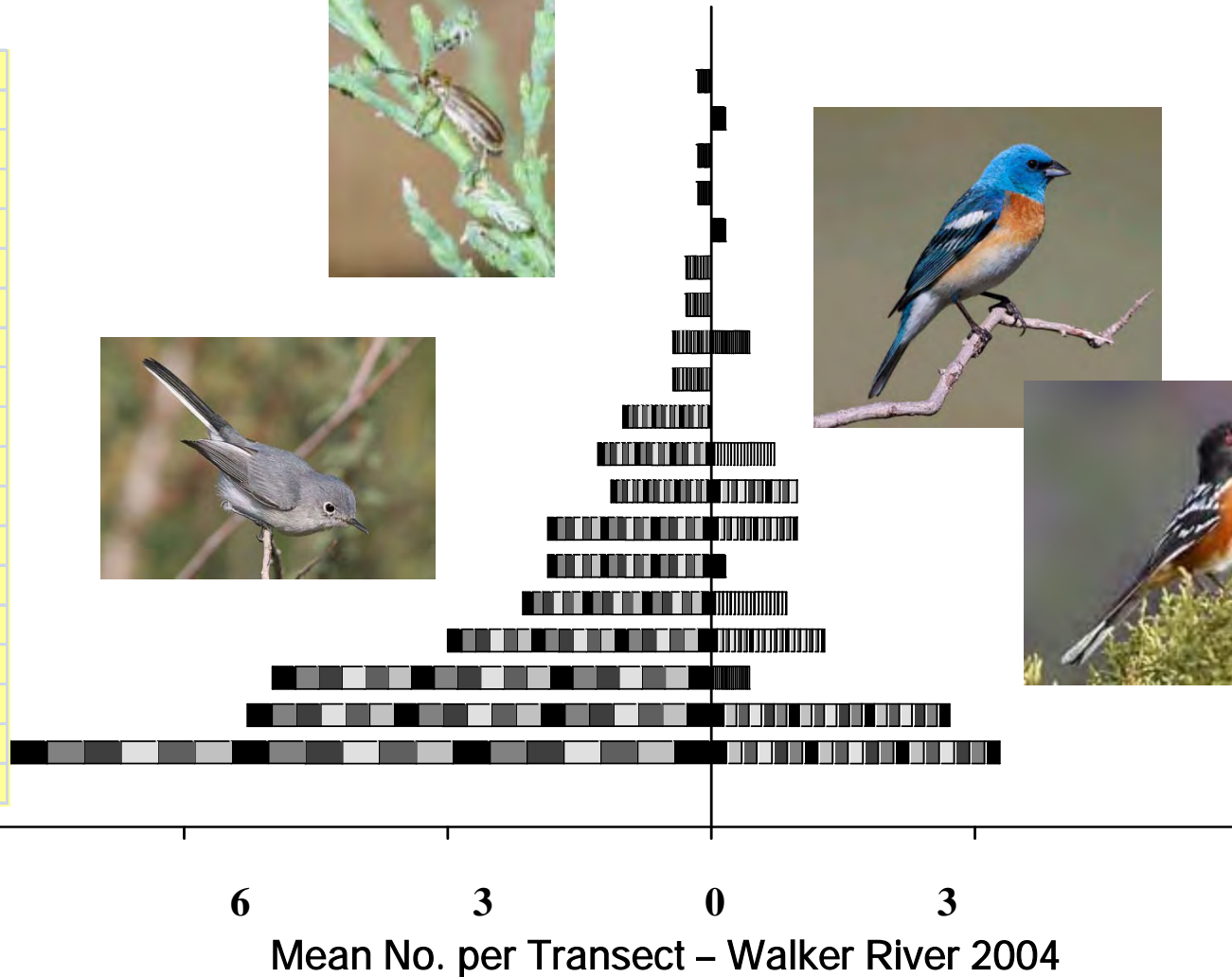
Birds and *Diorhabda* in Tamarisk (Longland et al.)

Diorhabda present

Diorhabda absent

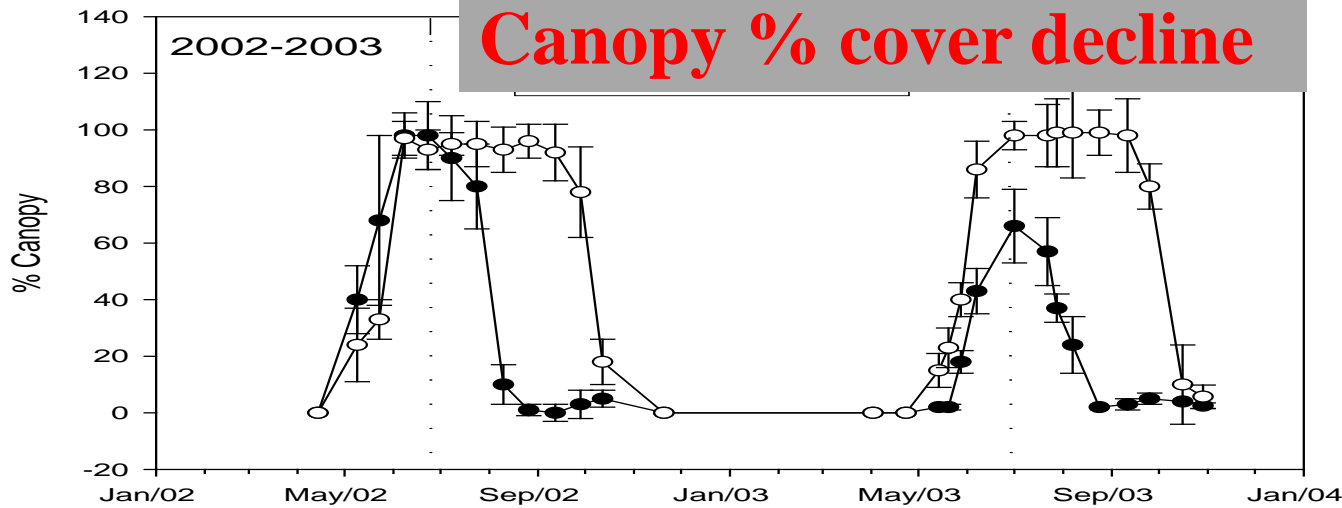


- bushtit
- yellow warbler
- sage sparrow
- Bullock's oriole
- Say's phoebe
- Townsend's warbler
- black-bill magpie
- lark sparrow
- western kingbird
- western meadowlark
- warbling vireo
- Bewick's wren
- blue grosbeak
- brown-head cowbird
- raven
- blue-grey gnatcatcher
- spotted towhee
- lazuli bunting



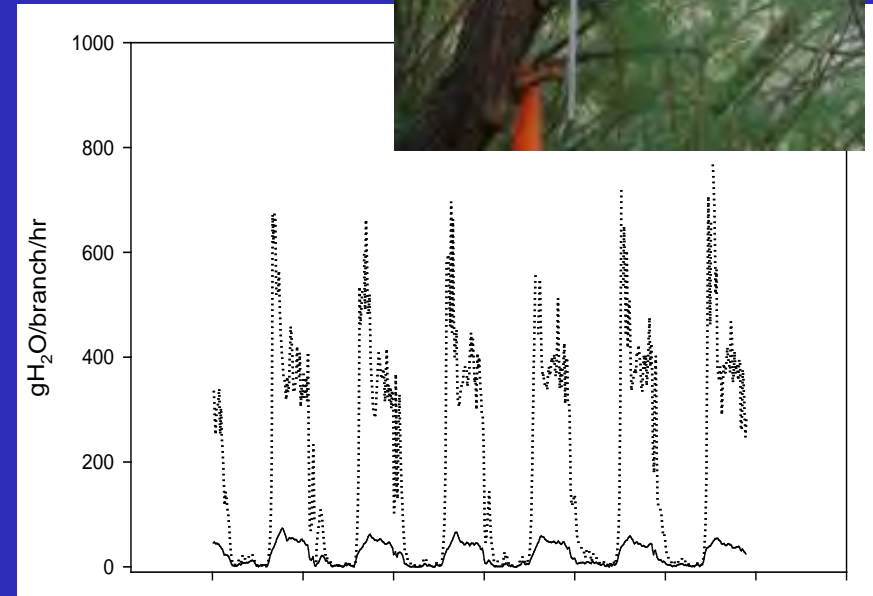
Ecosystem Benefits

Canopy % cover decline



Seasonal Evapotranspiration

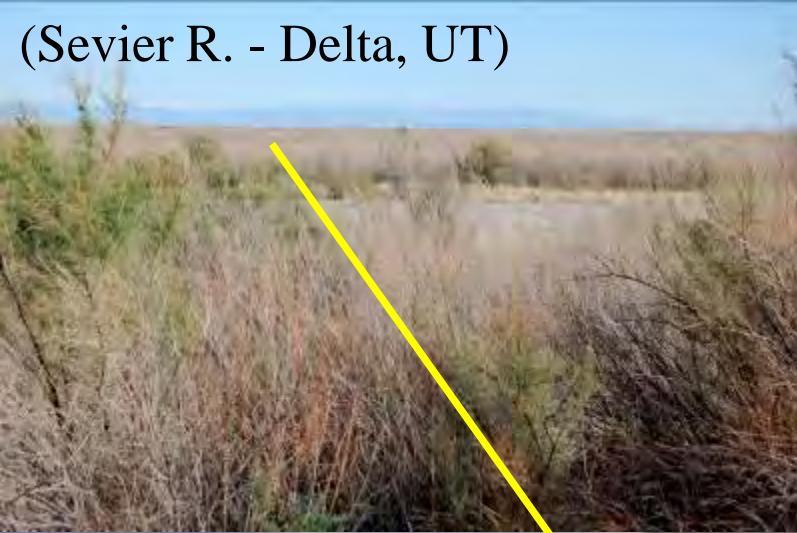
↓ 65% Yr 1, ↓ >90% Yr 2
(Pattison et al.)



Vegetation Recovery



Suppression allows
native release and
recruitment



(Sevier R. - Delta, UT)

Diorhabda introduced in 2006 to St. George, UT by county agents



Tamarisk defoliation in Virgin River in 2008



Diorhabda now in contact w/ SWFL



Spread and Defoliation can be Rapid & Dramatic

1 June 2010



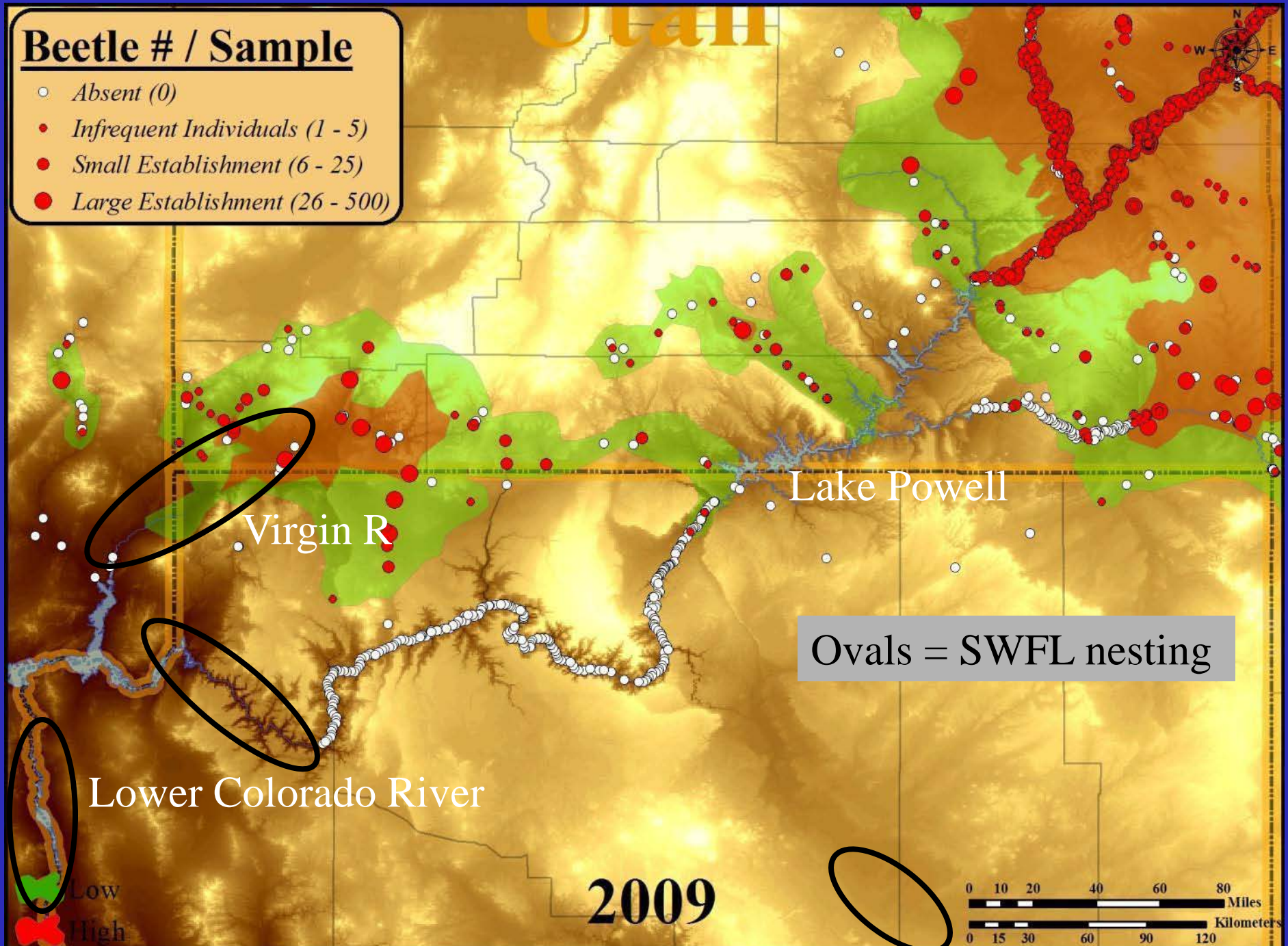
Virgin River:
Before/After
Biocontrol

1 July 2010



Beetle # / Sample

- Absent (0)
- Infrequent Individuals (1 - 5)
- Small Establishment (6 - 25)
- Large Establishment (26 - 500)



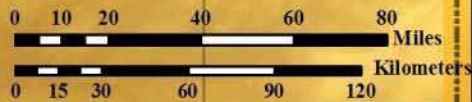
Virgin R

Lake Powell

Ovals = SWFL nesting

Lower Colorado River

2009



Low
High

NOT WANTED IN ARIZONA: TAMARISK LEAF BEETLES



Tamarisk beetles at St. George, Utah
Credit: Mary Ann McLeod, SWCA Assoc



Tamarisk beetle defoliation below St. George, Utah
Credit: Christiana Manville, U.S. Fish & Wildlife Service



Southwestern willow flycatcher nest in defoliated tamarisk on Virgin River, St. George, Utah
Credit: Pam Wheeler, Utah Division of Wildlife Resources



“Biological war wreaks havoc on endangered bird's habitat”

Associated Press



CENTER for BIOLOGICAL DIVERSITY

CBD sues USDA over perceived threats to SWFL

US Fish & Wildlife Service campaign poster

Does Biocontrol by *Diorhabda* pose a Threat?



Or, will 'Willow' Flycatcher survive without 'Willows'?



90% of nests in
Native or Mixed
Native/Exotic Veg

Sogge et al. 2005

Absent from *Tamarix*
Monocultures

Trend is toward
Tamarix dominance

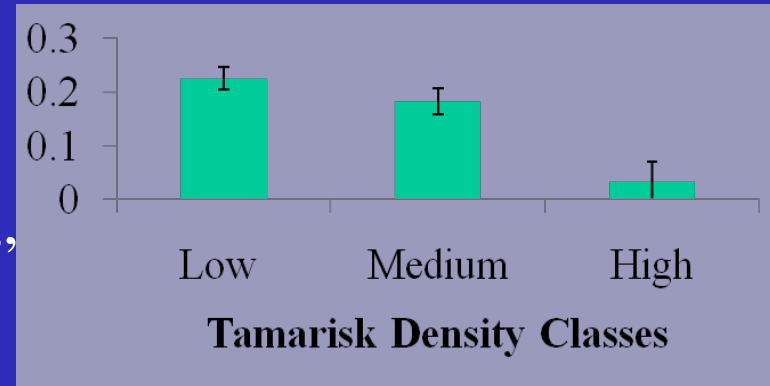
Mortensen et al. 2009, Whiteman 2009

Riparian Ecosystems are not static



Tamarix Dominance increases fire threat to native riparian veg

“21 of 25 saltcedar stands on the lower
Colorado River burned in a 15-year period”
(Anderson et al. 1977)



Drus et al. 2010



San Pedro R, AZ 2009



Warm Springs NWR, July 2010

...and to wildlife, e.g. SWFL –
2 unfledged nests destroyed



Does Willow recovery benefit SWFL?



“Hubbard (1987) found 55% of 20 nests in New Mexico to be in tamarisk...all from Elephant Butte Reservoir...and the sub-species no longer even occurs at Elephant Butte.”

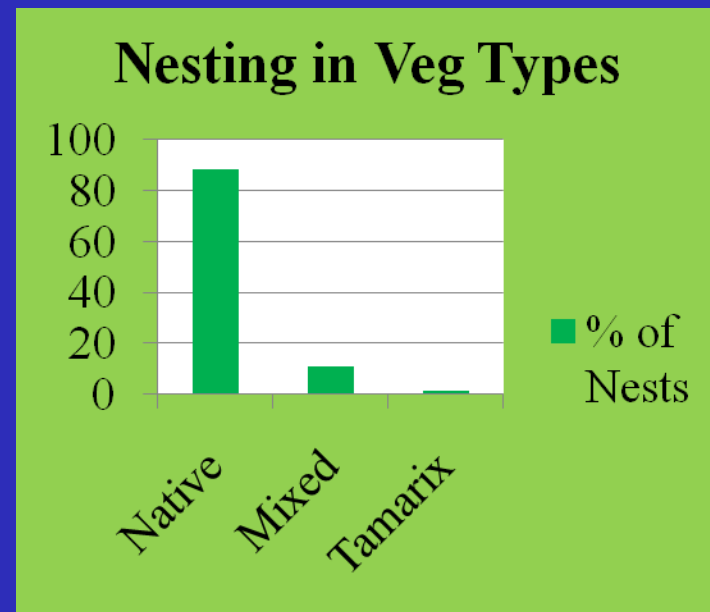
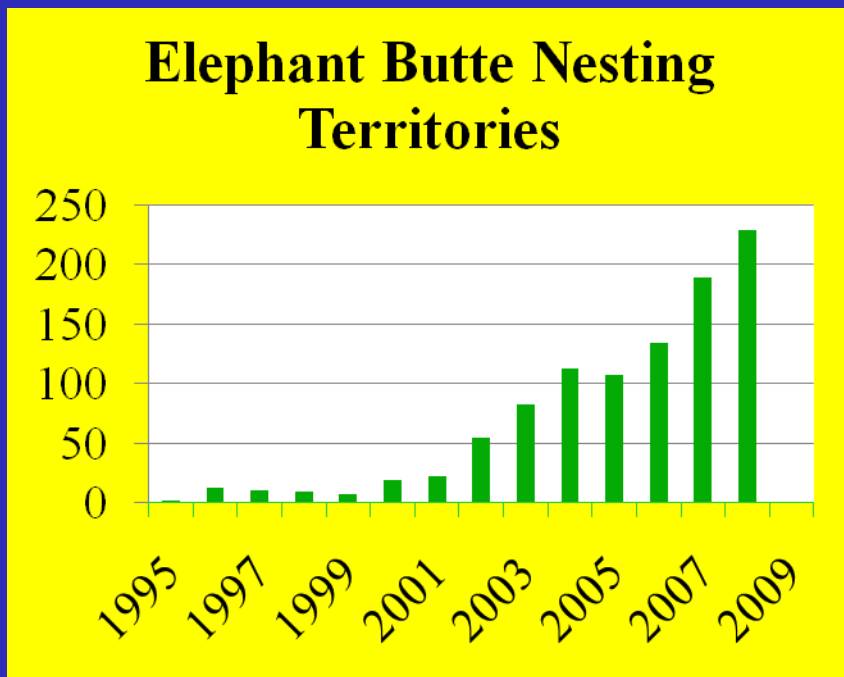


Elephant Butte, Rio Grande NM



Willow & Cottonwood
recovery at E.B. Reservoir

More Willows => More Flycatchers



(Ahlers & Moore 2009)

Similar response at Roosevelt Lake (Salt River) with SWFL recruitment to newly established willows after flooding

Tamarisk is not a preferred veg type,
but can be an acceptable element



Need strategies to inhibit
dominance and encourage
natives – with disturbance
[flood, fire, livestock]



Biocontrol can promote Native Diversity

Will active Re-vegetation lead to SWFL colonization?



Restoration projects in Virgin River Watershed:
2008 – 2010 (*Diorhabda* present)



Virgin River: St. George, UT With Willow Re-vegetation

(Utah Dept of Wildlife, M. McLoed)

2009 - 10 females (one in Native, 9 in tamarisk-dominated sites)

13% of nests fledged; 40% failed to hatch

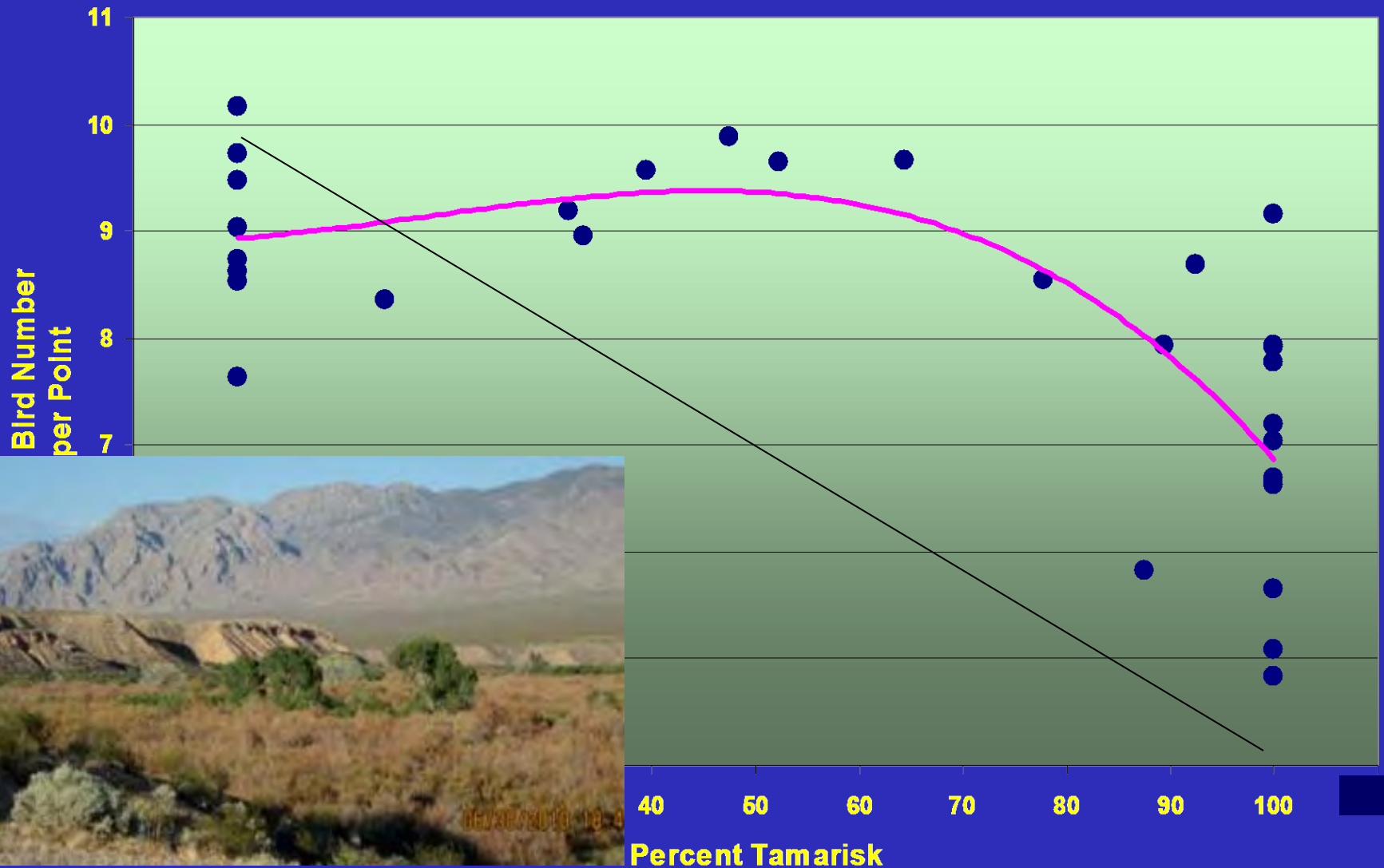
2010 - 9 females (major shift to native-dominated sites)

30% successfully fledged

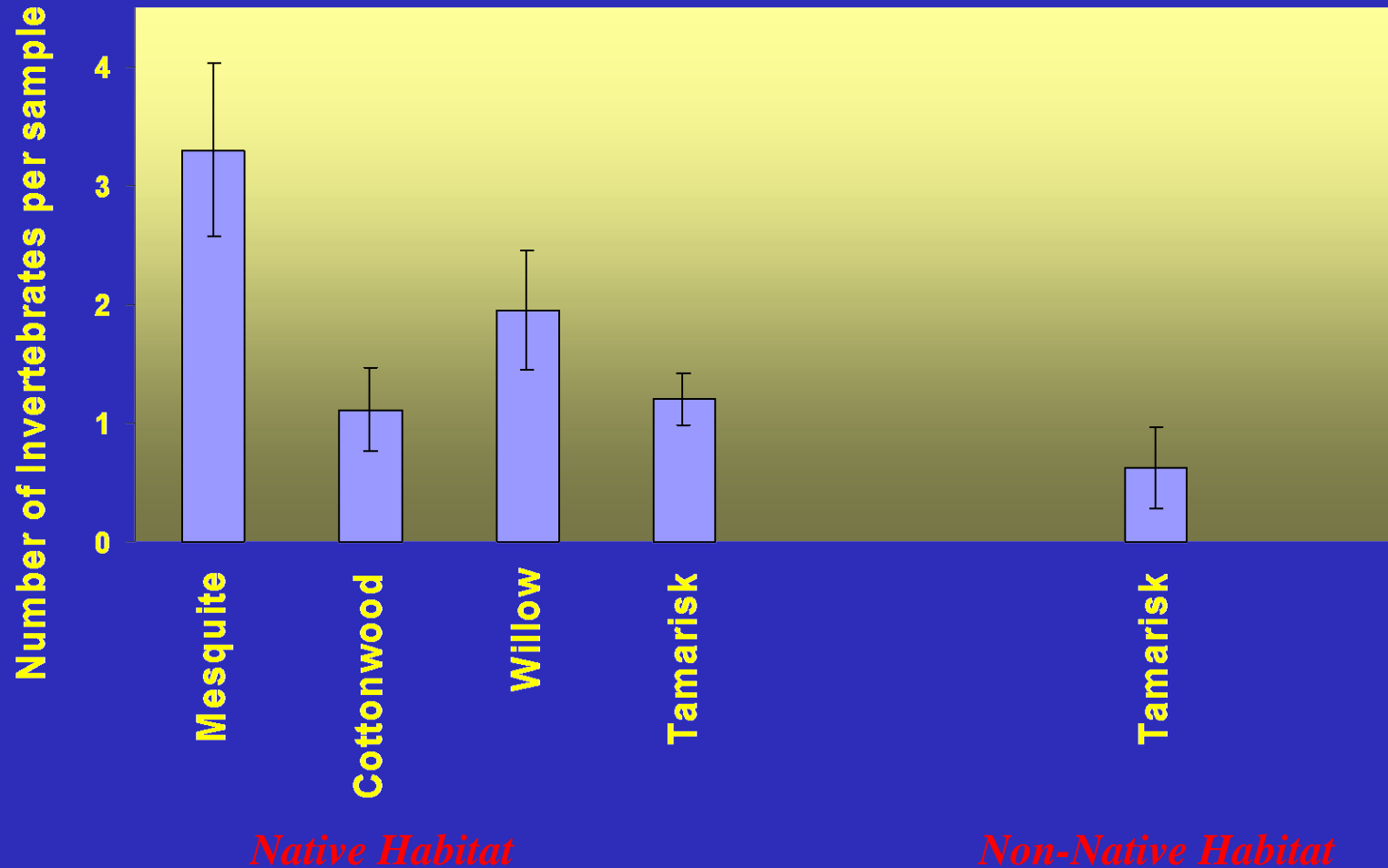


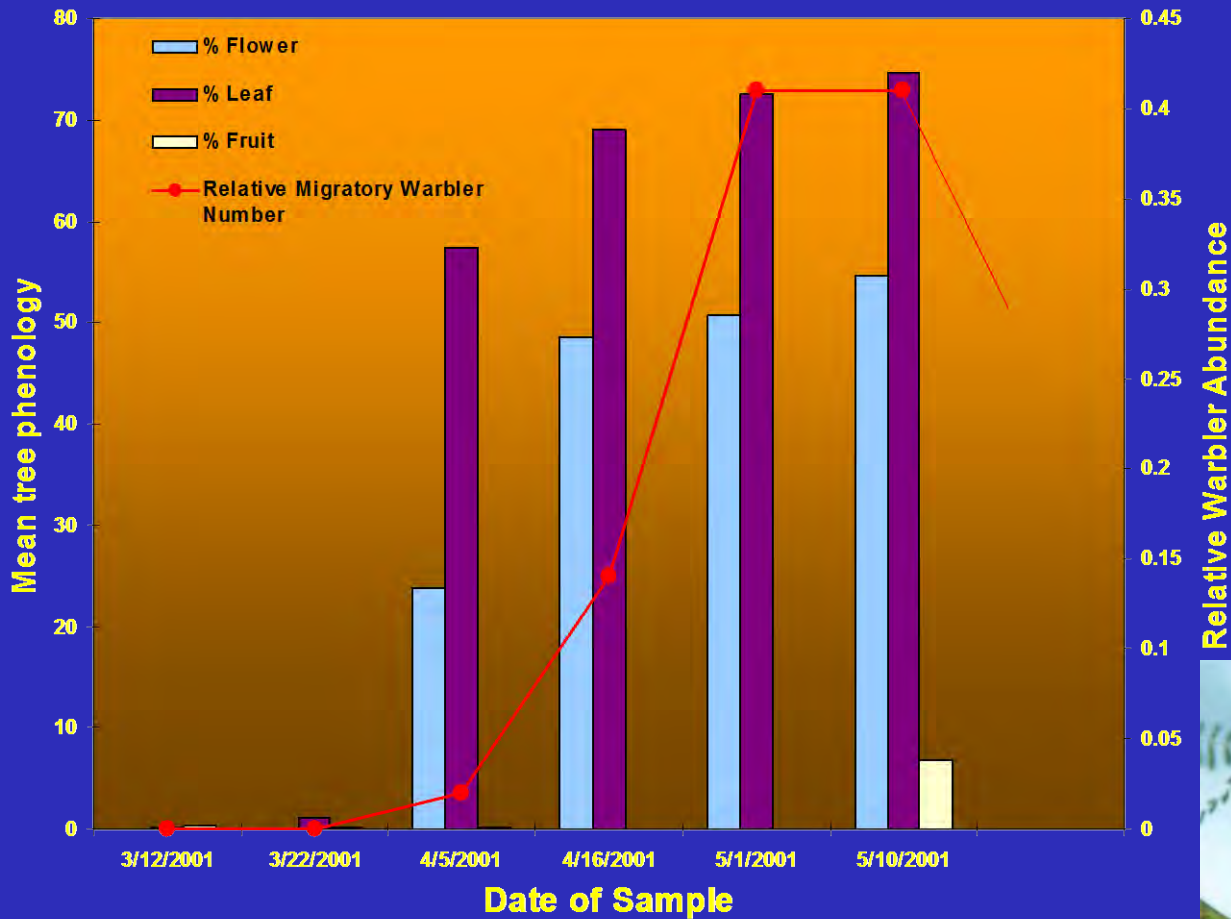
Threshold response by warblers to introduced vegetation

Point count data (van Riper et al.)



Arthropod Abundance on Mixed Vegetation vs. Monocultural Tamarisk





Honey Mesquite Flower Phenology

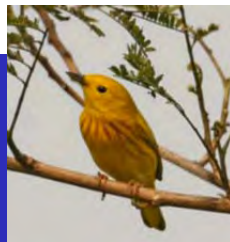
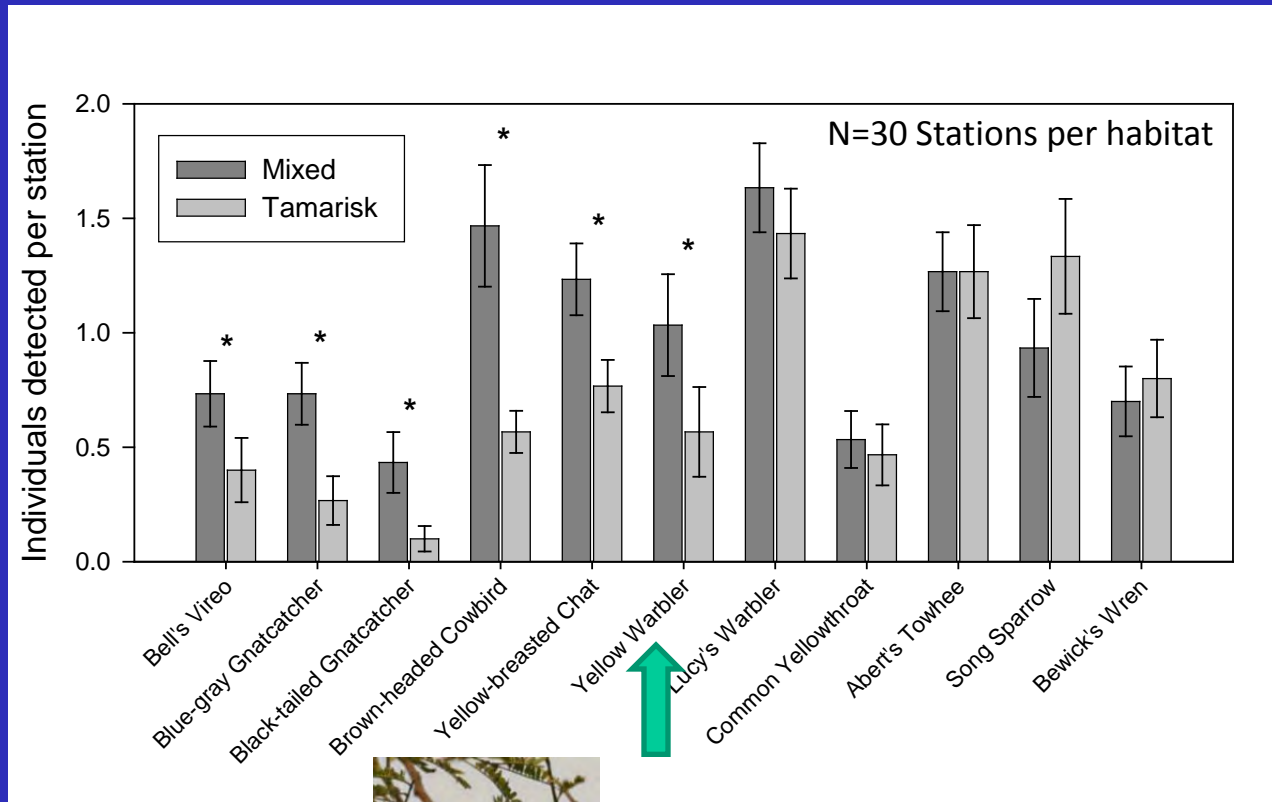
Warblers Cued to Mesquite Flowering
Tamarisk Use is Incidental



Virgin River Point Count Surveys

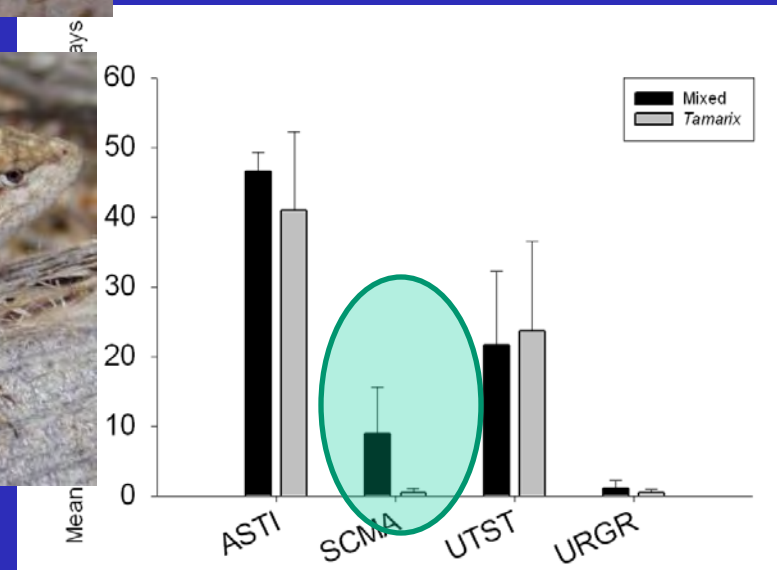
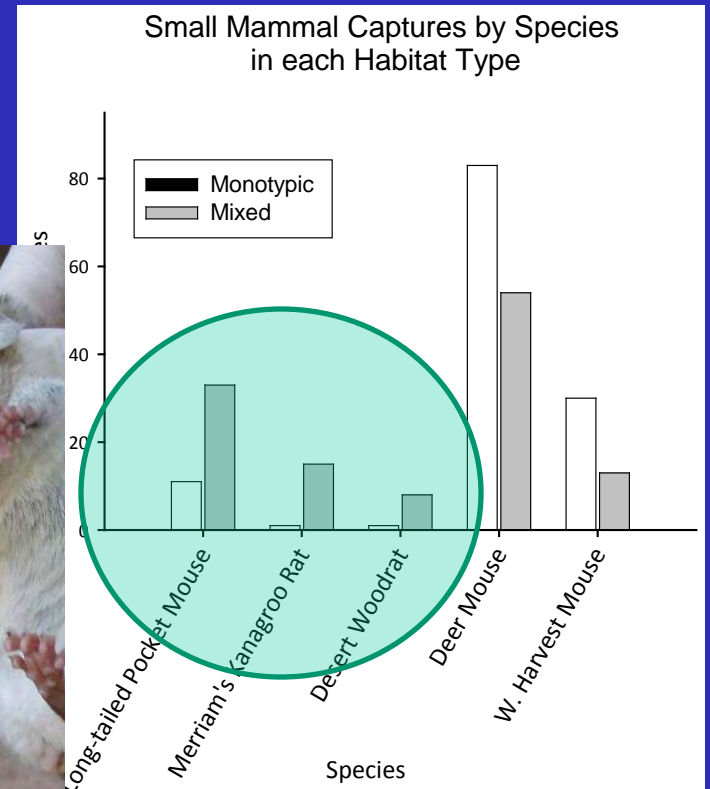
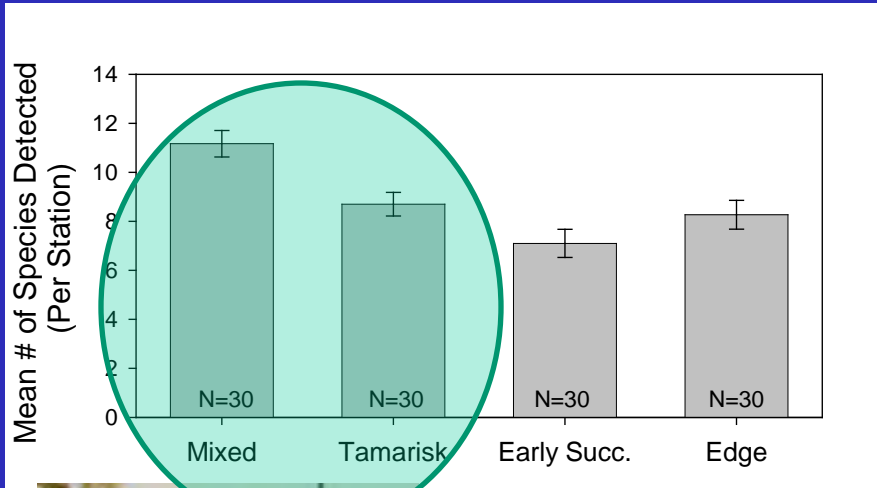
Relative Abundances: Mixed versus Tamarisk Habitats

- 6 of 11 species lower in *Tamarix*, including Yellow Warbler (SWFL proxy)

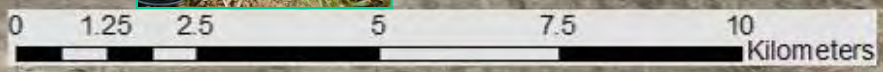
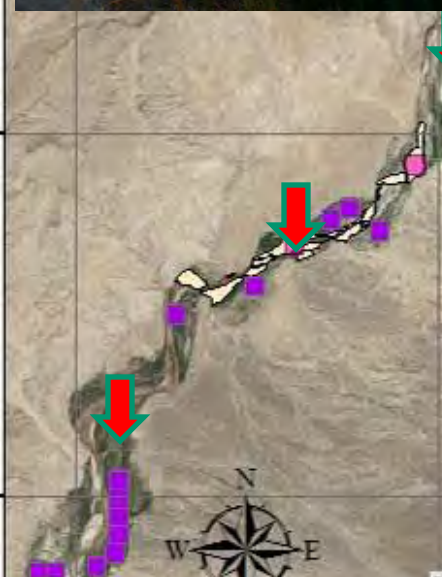
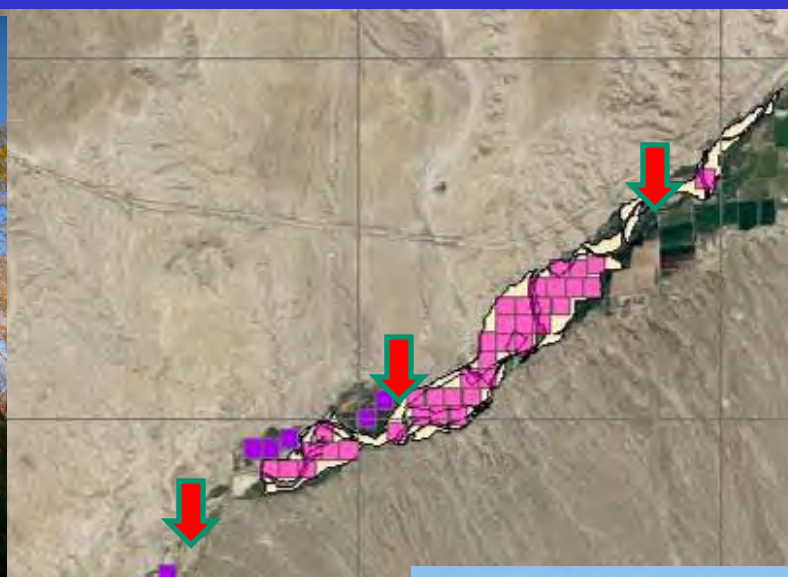


Willow flycatcher also may respond positively

Key: Retain or Restore Native Veg Element



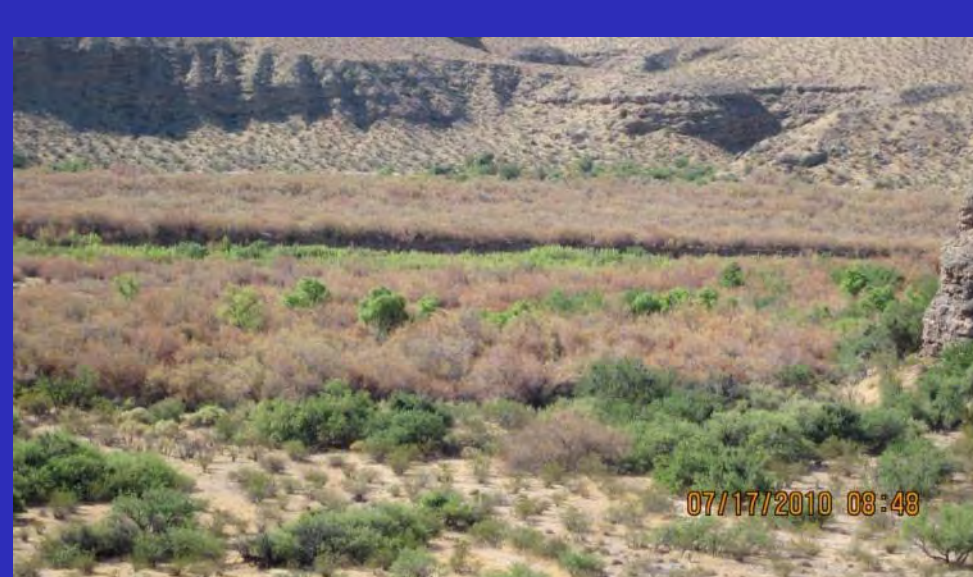
Propagule Islands Restoration Strategy



City of Mesquite
Restoration Site

Enhancing relative abundance of native plants, by BioControl, and Restoration where needed, will:

1. Improve wildlife abundance & diversity
2. Reduce wildfire risk & ecological impacts
3. Improve ecosystem function & services
4. Allow USDA and FWS to resolve ESA Conflict



Biodiversity on
Golf Courses?
Or back in our
Rivers?



Xinjiang, China

Sensitive species rare or absent in
Tamarix-dominated habitats



Phainopepla

Photo by Jim Stasz



Yellow breasted chat

Photo by C.S. Robbins



Common yellowthroat



Yellow billed cuckoo

Photo by J. A. Spendelov



Western pond turtle



Summer tanager

Photo by Stuart Tingley



Southwestern toad



Clapper rail

Photo by Jim Zingo